ACS

128 x 64 LCD

Display Terminal

User's Manual

6/14/2011 5:33 PM

ACS
Ackerman Computer Sciences

On The Cutting Edge of Technological Evolution

6233 E. Sawgrass Rd • Sarasota, FL. 34240 • (941)377-5775 FAX(941)378-4226
www.acscontrol.com

Table of Contents

Table of Contents 2

Overview 4

Features 4

Manual Conventions 5

Connections 6

RS-232 Connector 6
Speaker / Reset (SPKRESET) Connector 6
MENUPAD Connector 7

User Configuration 8

Entering User Configuration 8

Display Addressing 9

Display Flow Control 9

RS-485 Driver Enable 9

Display SOH/ETX Protocol 9

Print Command 10
Un-Print Command 11
Clear Command 13
Horizontal Load (Bitmap) Command 14
Graphic Command 15
Line Command 16
Box Command 17
Pixel Command 18
Circle Command 19
Tone Command 20
Save Page Command 21
Restore Page Command 22
Backlight Command 23
Keypad Status Poll Command 24
Keypad Close Response 24
Keypad Open Response 25
Power Up / Reset Response 25

Display ANSI Protocol 26

BELL 26
Backspace (BS) 26
Horizontal Tab (HT) 26
Line Feed (LF) 26
Vertical Tab (VT) 26
Form Feed (FF) 26

Carriage Return (CR) 26
Cancel (CAN) 26
Escape (ESC) 27
Displayed Characters 27
Reset Display (ESC c) 27
Cursor Down (ESC D) 27
Cursor Down to column 1 (ESC E) 27
Cursor Up (ESC M) 27
ANSI Escape Sequences (ESC [ ) 28
Cursor Up n lines (ESC [n A) 28
Cursor Up n lines to column 1 (ESC [n F) 28
Cursor Down n lines (ESC [n B) 28
Cursor Down n lines to column 1 (ESC [n E) 28
Cursor Right n characters (ESC [n C) 28
Cursor Left n characters (ESC [n D) 28
Move cursor to n (ESC [n G) 28
Move cursor to r, c (ESC [r ; c H) 28
Erase all or part of display (ESC [n J) 29
Erase all or part of line (ESC [n K) 29
Save cursor position (ESC [n s) 29
Restore cursor position (ESC [n u) 29
Query Device Status (ESC [5 n) 29
Query (ESC [6 n) 29
Keypad Close Response 30
Power Up / Reset Response 30

Firmware Revisions 31

Updating the LCD128x64 firmware 32

Board Layout 33

Keypad key code Layout 34

Debounce, SOH/ETX Protocol 34
Debounce, ANSI Protocol 34
Scan/Matrix 34

ASCII Table 35

Wiring Harness Diagram 38

Multiple Display Wiring 39

Mechanical Mounting Diagram 40

Membrane Switch Overlay 41

NOTICE: 42

Overview

The **ACS 128 x 64 LCD Display Terminal** is designed to provide a cost effective RS-232 operator interface. A high contrast 128 x 64 pixel LED backlight transflective LCD provides viewing in direct light, and well as indoors. It has a 12:00 to 6:00pm viewing angle, which means that it can be viewed from straight on to about 80 degrees downward. The backlight automatically turns on when characters are received or keypad inputs are activated, and shuts off after programmable period of no use. You can use your choice of matrix or non-matrix keypads, providing 7 to 12 inputs. An on board tone generator and amplifier can be used to provide user feedback.

Features

- FLASH Based for easy in-field software updates
- Transflective LCD Display with LED backlight and noon to 6:00PM viewing angle
- Single Power Supply
- Scan/Matrix & non-Matrix keypad inputs
- On board 250mW audio amplifier for tone generator
- On board diagnostic LED that indicates Rx and Tx activity
- 30 User programmable graphics pages expandable to 94
- User Configurable non-Volatile Settings for:
    - Baud Rate
    - Keypad Type:
        - Debounce (7 N.O. Switches)
        - Scan/Matrix (3 Column by 4 Row)
        - Send Keypad Opens as well as Closes
    - Backlight Timeout seconds
    - Display Logo On power-up
    - Display Settings On power-up
    - Protocol Selection:
        - SOH / ETX commands for full graphics
        - ANSI subset for scrolling character data
- Small form-factor, mounts in standard dual-gang electrical switchbox with optional mounting plate and membrane keypad overlay
- Low Power
    - 32mA Typical with LED Backlight Off
    - 190mA Typical with LED Backlight On

Manual Conventions

In this manual the following assumptions, abbreviations and conventions are used:

ASCII

ASCII stands for the American Standard Code for Information Interchange. As ASCII code is the agreed upon numerical representation of a character. (see ASCII Table Appendix)

ASCII Hex

The use of ASCII characters to represent one or more hexadecimal digits:

ASCII Character(s)	Represents Value
'0'	0
'1'	1
'2'	2
'3'	3
'4'	4
'5'	5
'6'	6
'7'	7
'8'	8
'9'	9
'A'	10
'B'	11
'C'	12
'D'	13
'E'	14
'F'	15
…	…
'10'	16
'28'	40
'7F'	127
'80'	128
'FF'	255

<SOH>

Represents a single ASCII Start of Heading character; CTRL-A, 01 decimal, 01 hex. This character delineates the start of a command or response in SOH/ETX protocol mode.

<ETX>

Represents a single ASCII End of Text character; CTRL-C, 03 decimal, 03 hex. This character delineates the end of a command or response in SOH/ETX protocol mode.

SOH/ETX Protocol

Represents the use of a command/response protocol where the messages are bracketed by the non-printing/displaying SOH and ETX characters and the bracketed message contents are expressed by a sequence of one or more printable/displayable characters.

Connections

RS-232 Connector

The following signals appear on the RS-232 DB-9P connector:

PIN	SIGNAL	Direction at display
2	RXD	IN
3	TXD	OUT
4	DTR(optional)*	OUT
5	GND	IN
9	+12-14VDC	IN

- DTR supported in v3.4 or later firmware

RS-232 Connection to PC

LCD Pin #	PC DB9 Pin #	PC DB25 Pin #	Power Supply	SIGNAL
2	3	2	N/C	RXD
3	2	3	N/C	TXD
4 (optional)	8 (optional)	5 (optional)	N/C	CTS
5	5	7	GND	GND
9	N/C	N/C	+12-14VDC	+12-14VDC

Be sure to connect both the Ground of the PC and the Ground of your +12-14VDC Power supply together!

The CTS connection is for optional transmit to the display flow control to prevent overflowing the display at higher baud rates. It requires v3.4 or later firmware in the display and implementation of flow control on the host device.

Speaker / Reset (SPKRESET) Connector

The following signals appear on the six pin KK-100 SPKRESET connector:

PIN	SIGNAL
1	GND
2	RESET-
3	GND
4	N/U
5	Speaker +
6	Speaker -

Pin #1 Identified by Square Pad, and signals are also identified by silkscreen legend on the board.

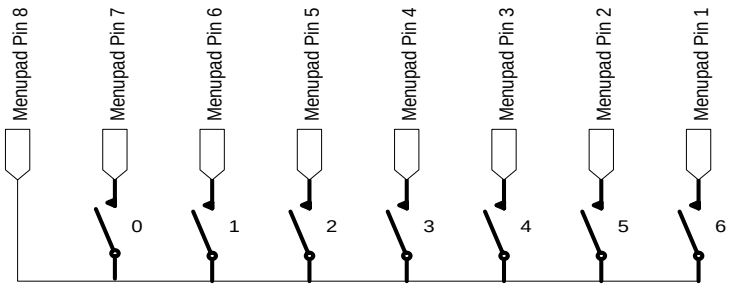
MENUPAD Connector

The following inputs are available on the "MENUPAD" connector:

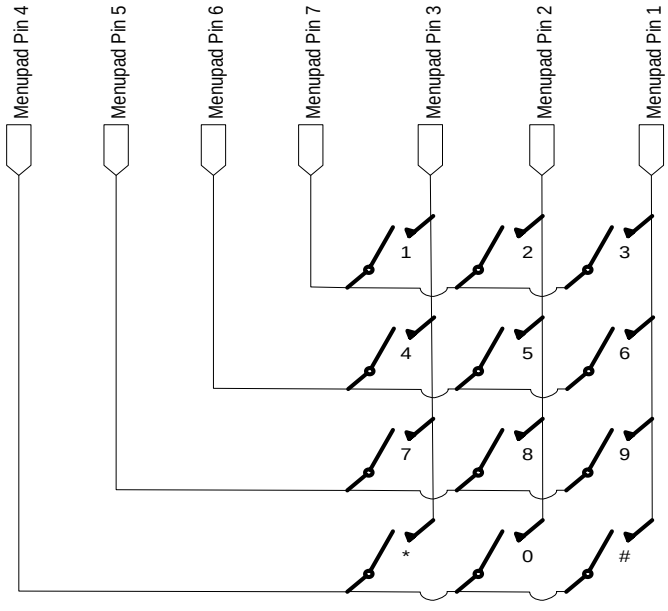
PIN	Debounce	Scan/Matrix
1	Input #7	Column #3
2	Input #6	Column #2
3	Input #5	Column #1
4	Input #4	Row #4
5	Input #3	Row #3
6	Input #2	Row #2
7	Input #1	Row #1
8	GND	GND

Pin #1 Identified by Square Pad

Debounce Wiring



Scan/Matrix Wiring



User Configuration

Entering User Configuration

To enter the User configuration menu:

1. Remove power, or hold the RESET button
2. On the MENUPAD connector, connect pin #4 and pin #7, to pin #8. (Hold down Buttons #1, and #4 on the membrane switch, if a overlay is installed)
3. Power up the display, or release the RESET button if power was not removed.
4. A configuration menu should appear. Remove the above connection.

A list of soft menus will appear across the bottom of the LCD. Push the corresponding KEYPAD buttons that are/would be below the menu items you wish to select.

Follow the on screen soft menus to edit, select, and edit the configuration values.

Be sure to press the save soft menu KEYPAD button after editing a value, to store/save it!

Some configuration settings will not take affect until the display is Reset.

Configuration Settings

Setting	Description
Baud Rate	1200, 2400, 4800, 9600 (default), 19200, 38400, 57600
Protocol SOH & ETX	0 = ANSI, 1=SOH/ETX(default)
ANSI Line Wrap	0 = no wrap (default), 1 = ANSI lines exceeding screen width wrap to next line
ANSI Add LF to CR	0 = CR (default), 1 = incoming CR replaced by CR/LF pair
Display Comm Addr	0 = no address (default), xx = display's address for SOH/ETX protocol
Rcv Char Backlight	0 = disabled, 1 = backlight on for time when characters received
Switch Backlight	0 = disabled, 1 = backlight on for time when switch pressed
Backlight Timeout	= number of seconds backlight stays lit (default = 30)
Switch Scan/Matrix	0 = debounce 7 keys (default), 1 = scan 3 x 4 matrix
Switch Send Opens	0 = only switch closures sent (default), 1 = send switch opens too
Switch Base Zero	0 = switch closures start at ASCII '0' (default), 1 = switch closures start at binary 0
Switches Polled	0 = switch closures send autonomously (default), 1 = switch closures history sent when polled
Power Up Disp Logo	0 = no logo upon reset, 1 = display graphic page 0 (logo) upon reset (default)
Power Up Disp Setng	0 = no settings shown upon reset, 1 = display settings screen upon reset (default)
Auto Clear Disp Sec	= number of seconds before display clears (default = 0, off)
Auto Clear DispLogo	= number of seconds before logo clears (default = 0, off)
RS485 Enable	0 = disabled (default), 1= enabled
Key Beep Enable	0 = disabled (default), 1 = enabled
Key Beep Freq	262Hz, 440Hz, 880Hz, 1397Hz (default), 1760Hz, 2093Hz, 3520Hz
Key Beep Secs/50	= duration of key beep in fiftieths of a second (default = 12)
Soft Major Version	= major version # of firmware
Soft Minor Version	= minor version # of firmware
End of Config	= end of configuration items placeholder
NV Status Byte	= NV status byte (default = 227)

Display Addressing

If you set the User Configuration Setting 'Display Comm Addr' item to a value greater than zero, you must take the following into consideration when using the SOH/ETX protocol:

Commands sent to the display must have a two-digit ASCII hex address sent between the leading <SOH>, and the following command letter. If the display's address does not match the address in the command, it will ignore the command. If a command is sent with an address of zero, it is considered a broadcast message, and all displays with an address set will display the command. This allows multiple displays to be updated via a single RS-232 interface.

Keystroke commands received from displays with their address greater than zero, will have the displays address in two digit ASCII hex between the <SOH> and the "K" or "k". Note that the return RS-232 signals from multiple displays would have to be 'OR'ed using circuitry such as diodes that are external to the display. See the **'Multiple Display Wiring'** section below.

The display addressing feature is not supported when using the ANSI protocol.

Display Flow Control

Display firmware version v3.4 or later provides optional support for flow control of transmit data to the display to prevent overflowing the display input buffer at higher baud rates. The display will assert its DTR signal on power-up and whenever there is room in its input buffer. The display will de-assert its DTR signal whenever the input buffer is at 90% or higher. The host device that the display is connected to should monitor the DTR signal, typically by connecting it to the CTS input, and only send transmit data to the display when the signal is asserted. Without flow control it is possible to overrun the display input buffer at baud rates above 9600 baud. Symptoms of input buffer overflow include missing or incorrectly displayed data or commands.

RS-485 Driver Enable

Display firmware version v4.1 or later provides configurable support for enabling an external RS-485 transceiver to transmit via the DTR signal. The display will assert its DTR signal whenever it needs to transmit data, then de-assert its DTR signal after the data is fully transmitted. Enabling this option in the configuration menu overrides the Display Flow Control via DTR above.

Display SOH/ETX Protocol

The display supports two different communications protocols: SOH/ETX and ANSI subset. The choice of which protocol is supported is selectable via the User Configuration function 'Protocol SOH & ETX' outlined above.

The SOH/ETX protocol allows full control of the display features and functionality, but requires that the host computer properly format sequences of commands using the protocol to control the display.

The following SOH/ETX protocol commands are supported:

Print Command

<SOH>
"P"
{Row 0-255 (FF) in Two Digit ASCII Hex}
{Starting Column 0-127(00-7F) in Two Digit ASCII Hex}
{Font 0-5 in Single Digit ASCII Hex}
{Type 1,2,4,8 in Single Digit ASCII Hex}
{Justification 0, 1, 2, 3 in Single Digit ASCII Hex}
{Up to 25 characters of text to be displayed}
<ETX>

Example: <SOH>P0100010TEST<ETX> would print "TEST" on row 0, column 0, with a 5x7 font

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

P

Value (ASCII 80 decimal / 50 hex). Starts Print command.

Row

Range (0-255 (00-FF hex)). A bit mask, 1 bit per row, the topmost row is the LSB 1 (01), and the bottommost row is the MSB 128 (80). A value of 255 (FF) affects all rows. Depending on the font used, this specifies which rows of the display the text will be displayed on. Using fonts 0 and 2, eight rows are available (0 - 7). Using font 1, seven rows are available. Since font 1 is a double row font, a value of 1 - prints on rows 0 and 1, 2 - prints on rows 1 and 2, and 4 - prints on rows 2 and 3, etc.

Starting Column

Range (0-127 (00-7F hex)). This specifies which column on the display that printing will start. If the text is longer than the remaining space to the right of the specified column, it will wrap to the next line. Wrapping of proportionally spaced text is not recommended. For fixed pitch font 4 this is the character position (0 – 20) on the line instead of the column number.

Font

Range (0-5 (0-5 hex)). Font 0 is a single line proportional 5 x 7 font, and can be printed on rows 0 – 7 (*See Row*). Font 1 is a double row proportional 9 x 16 font, and can be printed on rows 0 - 6. Font 2 is a single line proportional 4 x 5 font, and can be printed on rows 0 - 7. Font 3 is a proportional giant font (30 x 56) for numbers 0 - 9 only and can only be printed on rows 0 or 1. Font 4 is a fixed pitch 5 x 7 font that can be printed on all rows. Font 5 is a bit doubled version of Font 1 (18 x 32) and can be printed on rows 0 - 4. The specified W x H sizes are the maximum dimensions.

Type

Range (1, 2, 4, 8 (0-F hex)). Type 1 is normal, that is non-inverted black characters on a white background. Type 2 is inverted, and generates white letters on a black background.

Justification

Range (0, 1, 2, 3 (0-3 hex)). Type 0 = Left Justified, 1 = Center Justified, 2 = Right Justified, 3 = absolute positioning to the specified column or character depending upon the font.

Text to be displayed

Up to 25 characters of text to be displayed. Larger fonts display fewer characters. The Giant font can only display numbers consisting of the digits 0 through 9.

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to terminate/execute the command received.

Un-Print Command

<SOH>
"U"
{Row 0-255 (FF) in Two Digit ASCII Hex}
{Starting Column 0-127(00-7F) in Two Digit ASCII Hex}
{Font 0-5 in Single Digit ASCII Hex}
{Type 1,2,4,8 in Single Digit ASCII Hex}
{Justification 0, 1, 2, 3 in Single Digit ASCII Hex}
{Up to 25 characters of text to be un-displayed}
<ETX>

Example: <SOH>U0100010TEST<ETX> would un-print "TEST" on row 0, column 0, with a 5x7 font

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

U

Value (ASCII 85 decimal / 55 hex). Starts Un-Print command.

Row

Range (0-255 (00-FF hex)). A bit mask, 1 bit per row, the topmost row is the LSB 1 (01), and the bottommost row is the MSB 128 (80). A value of 255 (FF) affects all rows. Depending on the font used, this specifies which rows of the display the text will be un-displayed on. Using fonts 0 and 2, eight rows are available (0 - 7). Using font 1, seven rows are available. Since font 1 is a double row font, a value of 1 – un-prints on rows 0 and 1, 2 – un-prints on rows 1 and 2, and 4 – un-prints on rows 2 and 3, etc.

Starting Column

Range (0-127 (00-7F hex)). This specifies which column on the display that un-printing will start. If the text is longer than the remaining space to the right of the specified column, it will wrap to the next line. For fixed pitch font 4 this is the character position (0 – 20) on the line instead of the column number.

Font

Range (0-5 (0-5 hex)). Font 0 is a single line proportional 5 x 7 font, and can be un-printed on rows 0 – 7 (*See Row*). Font 1 is a double row proportional 9 x 16 font, and can be un-printed on rows 0 - 6. Font 2 is a single line proportional 4 x 5 font, and can be un-printed on rows 0 - 7. Font 3 is a proportional giant font (30 x 56) for numbers 0 - 9 only and can only be un-printed on rows 0 or 1. Font 4 is a fixed pitch 5 x 7 font that can be un-printed on all rows. Font 5 is a bit doubled version of Font 1 (18 x 32) and can be un-printed on rows 0 - 4. The specified W x H sizes are the maximum dimensions.

Type

Range (1, 2, 4, 8 (0-F hex)). Type 1 is normal, that is non-inverted black characters will be un-printed on a white background. Type 2 is inverted, and un-generates white letters on a black background.

Justification

Range (0, 1, 2, 3 (0-3 hex)). Type 0 = Left Justified, 1 = Center Justified, 2 = Right Justified, 3 = absolute positioning to the specified column or character depending upon the font.

Text to be displayed

Up to 25 characters of text to be un-displayed. Larger fonts display fewer characters. The Giant font can only display numbers consisting of the digits 0 through 9.

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to terminate/execute the command received.

Clear Command

<SOH>
"C"
{Row 0-255 (FF) in Two Digit ASCII Hex}
{Starting Column 0-127(00-7F) in Two Digit ASCII Hex}
{Ending Column 0-127(00-7F) in Two Digit ASCII Hex}
<ETX>

Example: <SOH>C01007F<ETX> would clear Row 0 from column 0 to column 127

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

C

Value (ASCII 67 decimal / 43 hex). Starts Clear command.

Row

Range (0-255 (00-FF hex)). A bit mask, 1 bit per row, the topmost row is the LSB 1 (01), and the bottommost row is the MSB 128 (80). A value of 255 (FF) affects all rows. Depending on the font used, this specifies which rows of the display the text will be cleared.

Starting Column

Range (0-127 (00-7F hex)). This specifies which column on the display, that clearing will start. This value must never be greater than the Ending Column!

Ending Column

Range (0-127 (00-7F hex)). This specifies which column on the display, that clearing will End. This value must never be less than the Starting Column!

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to terminate/execute the command received.

Horizontal Load (Bitmap) Command

<SOH>
"H"
{Row 0-255 (00-FF hex) in Two Digit ASCII Hex}
{Column 0-127(00-7F hex) in Two Digit ASCII Hex}
{Length of data 0-128(00-80 hex) in Two Digit ASCII Hex}
{Data Bytes 0-255(00-FF hex) in Two Digit ASCII Hex}
<ETX>

Example: <SOH>H010001FF<ETX> would draw a vertical line on row 0, 8 bits high

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

H

Value (ASCII 72 decimal / 48 hex). Starts Horizontal Load command.

Row

Range (0-255 (00-FF hex)). A bit mask, 1 bit per row, the topmost row is the LSB 1 (01), and the bottommost row is the MSB 128 (80). A value of 255 (FF) affects all rows. Depending on the font used, this specifies which rows of the display the data will be displayed on.

Column

Range (0-127 (00-7F hex)). This specifies which column on the display, that the data will be placed at.

Length

Range (0-128 (00-80 hex)). This is the number of bytes of data that follows.

Data Bytes

Range (0-255 (00-FF hex)). These are the binary patterns of dots you would like turned on/off at the specified location on the display. Each byte represents 8 pixels on the row, LSB is towards the top of the display on each row, MSB is towards the bottom of the display on each row. A '1' in a bit position turns on the corresponding pixel. Successive bytes are displayed from left to right on the same row. Bytes that would appear beyond the end of the row are not displayed.

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to terminate/execute the command received.

NOTE: Multiple Horizontal Load commands may be used to display a bitmap image on the display.

Graphic Command

<SOH>
"G"
{Row 0-255 (00-FF hex) in Two Digit ASCII Hex}
{Column 0-127(00-7F) in Two Digit ASCII Hex}
{Data 0-255(00-FF) in Two Digit ASCII Hex}
<ETX>

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

G

Value (ASCII 71 decimal). Starts Graphics command.

Row

Range (0-255 (00-FF hex)). A bit mask, 1 bit per row, the topmost row is the LSB 1 (01), and the bottommost row is the MSB 128 (80). A value of 255 (FF) affects all rows. Depending on the font used, this specifies which rows of the display the data will be displayed on.

Column

Range (0-127). This specifies which column on the display, that the data will be placed at.

Data

Range (0-255). This is the binary pattern of dots/lamps you would like turned on/off at the specified location on the display. LSB is towards the top of the display on each row, MSB is towards the bottom of the display on each row. A '1' in a bit position turns on the corresponding pixel.

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to terminate/execute the command received.

Line Command

<SOH>
"L"
{Starting X 0-127(00-7F) in Two Digit ASCII Hex}
{Starting Y 0-63(00-3F) in Two Digit ASCII Hex}
{Ending X 0-127(00-7F) in Two Digit ASCII Hex}
{Ending Y 0-63(00-3F) in Two Digit ASCII Hex}
{Color 0-1(0-1) in Single Digit ASCII Hex}
<ETX>

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

L

Value (ASCII 76 decimal). Starts Line command.

Starting X

Range (0-127). This specifies the starting x coordinate of the line.

Starting Y

Range (0-63). This specifies the starting y coordinate of the line.

Ending X

Range (0-127). This specifies the ending x coordinate of the line. It must be greater than the starting x value.

Ending Y

Range (0-63). This specifies the ending y coordinate of the line. It must be greater than the starting y value.

Color

Range (0-1). This specifies the color (0 = OFF, 1 = ON) of the line.

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to terminate/execute the command received.

Box Command

<SOH>
"B"
{1st Corner X 0-127(00-7F) in Two Digit ASCII Hex}
{1st Corner Y 0-63(00-3F) in Two Digit ASCII Hex}
{2nd Corner X 0-127(00-7F) in Two Digit ASCII Hex}
{2nd Corner Y 0-63(00-3F) in Two Digit ASCII Hex}
{Color 0-1(0-1) in Single Digit ASCII Hex}
<ETX>

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

B

Value (ASCII 66 decimal). Starts Box command.

1st Corner X

Range (0-127). This specifies the starting x coordinate of the box.

1st Corner Y

Range (0-63). This specifies the starting y coordinate of the box.

2nd Corner X

Range (0-127). This specifies the ending x coordinate of the box. It must be greater than the 1st corner x value.

2nd Corner Y

Range (0-63). This specifies the ending y coordinate of the box. It must be greater than the 1st corner y value.

Color

Range (0-1). This specifies the color (0 = OFF, 1 = ON) of the box.

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to terminate/execute the command received.

Pixel Command

<SOH>
"X"
{X 0-127(00-7F) in Two Digit ASCII Hex}
{Y 0-63(00-3F) in Two Digit ASCII Hex}
{Color 0-1(0-1) in Single Digit ASCII Hex}
<ETX>

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

X

Value (ASCII 88 decimal). Starts Pixel command.

X

Range (0-127). This specifies the x coordinate of the pixel.

Y

Range (0-63). This specifies the y coordinate of the pixel.

Color

Range (0-1). This specifies the color (0 = OFF, 1 = ON) of the pixel.

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to terminate/execute the command received.

Circle Command

<SOH>
"l"
{Center X 0-127(00-7F) in Two Digit ASCII Hex}
{Center Y 0-63(00-3F) in Two Digit ASCII Hex}
{Radius X 0-127(00-7F) in Two Digit ASCII Hex}
{Color 0-1(0-1) in Single Digit ASCII Hex}
<ETX>

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

l

{lower case "L"}Value (ASCII 108 decimal). Starts Circle command.

Center X

Range (0-127). This specifies the center x coordinate of the line.

Center Y

Range (0-63). This specifies the cneter y coordinate of the line.

Radius

Range (0-127). This specifies the radius of the circle. It must be greater than 0.

Color

Range (0-1). This specifies the color (0 = OFF, 1 = ON) of the line.

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to terminate/execute the command received.

Tone Command

<SOH>
"T"
{Frequency 26-4095Hz (01A-FFF) in Three Digit ASCII Hex}
{Duration 0-255 Fiftieths (00-FF) in Two Digit ASCII Hex}
<ETX>

Example: <SOH>T01A32<ETX> would play a tone of 26Hz, for 50 Fiftieths(1 Second)

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

T

Value (ASCII 84 decimal / 54 hex). Starts Tone command.

Frequency

Range (26-4095 (1A-FFF hex)). This specifies the frequency of the produced tone. A frequency of 0 turns off any current tone.

Duration

Range (0-255 (00-FF hex)). This specifies the duration of the tone in fiftieths of a second. A duration of 0 produces a constant tone.

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to terminate/execute the command received.

Save Page Command

<SOH>
"S"
{Page number 0-255 (00-FF) in Two Digit ASCII Hex}
<ETX>

Example: <SOH>S01<ETX> would save the current display image in non-volatile memory Page 1

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

S

Value (ASCII 83 decimal / 53 hex). Starts Save page command.

Page number

Range (0-255 (00-FF hex)). This specifies the number of the page to save the current display image into. The base unit has a single non-volatile memory device that provides storage for the User Configuration settings and 30 pages. Two additional memory devices may be installed to provide up to 94 pages in increments of 32. Accessing a page number outside of the range of installed memory will result in an error message being shown on the display.

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to terminate/execute the command received.

NOTE: Page 0 is the logo page that is displayed on reset or power-up if enabled in the User Configuration settings. Defaulting the User Configuration overwrites page 0 with the factory logo.

NOTE: There is a delay of up to 1/10 of a second (100mSEC) for the display to write the image into the non-volatile memory. Commands may be sent to the display during this time, but will not be executed until after the delay has expired which may result in overrun of the input data buffer and loss or incorrect operation of the commands that were sent.

NOTE: Each page may be written up to 100,000 times before incorrect saving of the image may result.

Restore Page Command

<SOH>
"R"
{Page number 0-255 (00-FF) in Two Digit ASCII Hex}
<ETX>

Example: <SOH>R01<ETX> would restore the display image from non-volatile memory Page 1

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

S

Value (ASCII 83 decimal / 53 hex). Starts Restore page command.

Page number

Range (0-255 (00-FF hex)). This specifies the number of the page to restore the current display image from. The base unit has a single non-volatile memory device that provides storage for the User Configuration settings and 30 pages. Two additional memory devices may be installed to provide up to 94 pages in increments of 32. Accessing a page number outside of the range of installed memory will result in an error message being shown on the display.

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to terminate/execute the command received.

NOTE: Page 0 is the logo page that is displayed on reset or power-up if enabled in the User Configuration settings. Defaulting the User Configuration overwrites page 0 with the factory logo.

Backlight Command

<SOH>
"b"
{value = 0, 1 or 2 as single Digit ASCII Hex}
<ETX>

Example: <SOH>b0<ETX> would turn off the backlight, <SOH>b1<ETX> would turn on the backlight, <SOH>b2<ETX> would turn on the backlight for the configured time, after which it would go off.

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

b

Value (ASCII 98 decimal / 62 hex). Starts backlight command.

Value

Range (0, 1, 2 (0-2 hex)). This specifies the value to set the backlight to: 0 = off, 1 = on, 2 = on timed.

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to terminate/execute the command received.

NOTE: This command is implemented in display firmware v3.5 and later. If the backlight is configured to turn on with received characters, it will not be possible to turn it off using this command.

Keypad Status Poll Command

<SOH>
"K"
<ETX>

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

K

Value (ASCII 75 decimal / 4B hex). Indicates start of Keypad Status Poll command.

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to delimit the response received.

NOTE: Starting with firmware revision 4.0, when the display is configured for Switches Polled = 1, keypad / reset response messages are not sent when they occur. Instead, the messages are queued and are sent upon receipt of this poll command in the order that they were generated. If the queue is empty, a <SOH><NAK><ETX> response message is sent instead. The queue holds approximately 18 messages. If the queue is full, newer responses are discarded. Only complete response messages are queued / transmitted. In this mode, failure to poll frequently may result in lost keypad responses.

Keypad Close Response

<SOH>
"K"
{Two Digit ASCII Hex keycode}
<ETX>

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

K

Value (ASCII 75 decimal / 4B hex). Indicates start of Keypad Close response.

Keycode

Debounce Range (30 hex – 36 hex). This specifies which key that was pressed on the keypad
Scan/Matrix Range (23, 2A, 30 hex – 39 hex). This specifies which key that was pressed on the keypad

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to delimit the response received.

Keypad Open Response

<SOH>
"k"
{Two Digit ASCII Hex keycode}
<ETX>

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

k

Value (ASCII 107 decimal / 6B hex). Indicates start of Keypad Open response.

Keycode

Debounce Range (30 hex – 36 hex). This specifies which key that was pressed on the keypad
Scan/Matrix Range (23, 2A, 30 hex – 39 hex). This specifies which key that was pressed on the keypad

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to delimit the response received.

NOTE: User Configuration Setting 'Switch Send Opens' must be set for Keypad Opens to be sent!

Power Up / Reset Response

<SOH>
"R"
<ETX>

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

R

Value (ASCII 82 decimal). Indicates the start of the Reset response.

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to delimit the response received.

Display ANSI Protocol

The display supports two different communications protocols: SOH/ETX and ANSI subset. The choice of which protocol is supported is selectable via the User Configuration function outlined above.

The ANSI subset protocol allows the display to be used as a limited ANSI terminal with scrolling. The display consists of 8 lines of 21 characters shown using a fixed pitch 5 x 7 font. The display supports the concept of a 'cursor', which is not currently displayed, but represents the insertion point on the display where the next printable text will be placed.

The following ANSI protocol commands are supported:

BELL

Value (ASCII 7 decimal / 07 hex) Receipt of this character causes the display to produce a 1KHz tone for 0.2 seconds.

Backspace (BS)

Value (ASCII 8 decimal / 08 hex) Receipt of this character causes the display to move the cursor one position to the left.

Horizontal Tab (HT)

Value (ASCII 9 decimal / 09 hex) Receipt of this character causes the display to move the cursor right to the next tab stop. Moving past the rightmost tab stop causes the cursor to move to the beginning of the following line with display scrolling up if the cursor was on the last line. There are 4 tab stops per line at positions 4, 8, 12 and 16.

Line Feed (LF)

Value (ASCII 10 decimal / 0A hex) Receipt of this character causes the display to move the cursor down to the next line in the same column. The display will scroll up if the cursor was on the last line.

Vertical Tab (VT)

Value (ASCII 11 decimal / 0B hex) Receipt of this character causes the display to move the cursor down to the next line in the same column. The display will scroll up if the cursor was on the last line.

Form Feed (FF)

Value (ASCII 12 decimal / 0C hex) Receipt of this character causes the display to move the cursor down to the next line in the same column. The display will scroll up if the cursor was on the last line.

Carriage Return (CR)

Value (ASCII 13 decimal / 0D hex) Receipt of this character causes the display to move the cursor left to the first column on the current line. There is a User Configuration setting that will automatically add receipt of a Line Feed (LF) character after a carriage return if required.

Cancel (CAN)

Value (ASCII 24 decimal / 18 hex) Receipt of this character causes the display to abort any escape sequence that may be in process. No other action is taken.

Escape (ESC)

Value (ASCII 27 decimal / 1B hex) Receipt of this character causes the display to attempt to decode one or more of the following characters as a control or escape sequence that will affect the display.

Displayed Characters

Values (ASCII 32 decimal / 20 hex through ASCII 127 decimal / 7F hex) Receipt of these characters cause the display to show the character on the screen at the current cursor location, and then move the cursor right to the next position. There is a User Configuration setting that will automatically wrap the cursor to the beginning of the next line, if required, scrolling up if the cursor was on the last line. The following characters are displayed:

	Upper Bits					
Lower Bits	0010	0011	0100	0101	0110	0111
0000	space	0	@	P	`	p
0001	!	1	A	Q	a	q
0010	"	2	B	R	b	r
0011	#	3	C	S	c	s
0100	$	4	D	T	d	t
0101	%	5	E	U	e	u
0110	&	6	F	V	f	v
0111	'	7	G	W	g	w
1000	(	8	H	X	h	x
1001	)	9	I	Y	i	y
1010	*	:	J	Z	j	z
1011	+	;	K	[	k	{
1100	,	<	L	\	l	|
1101	-	=	M	]	m	}
1110	.	>	N	^	n	→
1111	/	?	O	_	o	←

Reset Display (ESC c)

Values (ASCII 27, 99 decimal / 1B, 63 hex) Receipt of this character sequence causes the display to clear, the cursor position to move to the upper left corner and the backlight to turn off.

Cursor Down (ESC D)

Values (ASCII 27, 68 decimal / 1B, 44 hex) Receipt of this character sequence causes the display to move the cursor down to the next line in the same column. The cursor will not move and the display will not scroll up if the cursor was on the last line.

Cursor Down to column 1 (ESC E)

Values (ASCII 27, 69 decimal / 1B, 45 hex) Receipt of this character sequence causes the display to move the cursor down to the next line and the first column. The cursor will not move and the display will not scroll up if the cursor was on the last line.

Cursor Up (ESC M)

Values (ASCII 27, 77 decimal / 1B, 4D hex) Receipt of this character sequence causes the display to move the cursor up to the previous line in the same column. The cursor will not move if the cursor was on the first line.

ANSI Escape Sequences (ESC [ )

Values (ASCII 27, 91 decimal / 1B, 5B hex) Receipt of this character sequence causes the display to attempt to decode one or more of the following characters as an ANSI control sequence. These sequences can have 1 or 2 parameters that are expressed as decimal numbers separated by a semicolon. The absence of a parameter in a control sequence causes it to assume a default value of zero.

Cursor Up n lines (ESC [n A)

Values (ASCII 27, 91, 48-57, 65 decimal / 1B, 5B, 30-39, 41 hex) Receipt of this character sequence causes the display to move the cursor up 'n' lines in the same column. The cursor will not move up past the first line in the display.

Cursor Up n lines to column 1 (ESC [n F)

Values (ASCII 27, 91, 48-57, 70 decimal / 1B, 5B, 30-39, 46 hex) Receipt of this character sequence causes the display to move the cursor up 'n' lines and to the first column. The cursor will not move up past the first line in the display.

Cursor Down n lines (ESC [n B)

Values (ASCII 27, 91, 48-57, 66 decimal / 1B, 5B, 30-39, 42 hex) Receipt of this character sequence causes the display to move the cursor down 'n' lines in the same column. The cursor will not move past the bottom line in the display and the display will not scroll up.

Cursor Down n lines to column 1 (ESC [n E)

Values (ASCII 27, 91, 48-57, 69 decimal / 1B, 5B, 30-39, 45 hex) Receipt of this character sequence causes the display to move the cursor down 'n' lines and to the first column. The cursor will not move past the bottom line in the display and the display will not scroll up.

Cursor Right n characters (ESC [n C)

Values (ASCII 27, 91, 48-57, 67 decimal / 1B, 5B, 30-39, 43 hex) Receipt of this character sequence causes the display to move the cursor right 'n' characters on the same line. The cursor will not move past the end of the current line.

Cursor Left n characters (ESC [n D)

Values (ASCII 27, 91, 48-57, 68 decimal / 1B, 5B, 30-39, 44 hex) Receipt of this character sequence causes the display to move the cursor left 'n' characters on the same line. The cursor will not move past the beginning of the current line.

Move cursor to n (ESC [n G)

Values (ASCII 27, 91, 48-57, 71 decimal / 1B, 5B, 30-39, 47 hex) Receipt of this character sequence causes the display to move the cursor to column 'n' on the current line. The cursor will not move past the beginning or end of the current line.

Move cursor to r, c (ESC [r ; c H)

Values (ASCII 27, 91, [[48-57], 59, [48-57]], 72 decimal / 1B, 5B, [[30-39], 3B, [30-39]], 48 hex) Receipt of this character sequence causes the display to move the cursor to row 'r', column 'c'. The value for 'r' ranges from 0 – 7, the value for 'c' ranges from 0 – 20.

Erase all or part of display (ESC [n J)

Values (ASCII 27, 91, 48-50, 74 decimal / 1B, 5B, 30-32, 4A hex) Receipt of this character sequence causes part or all of the display to clear. If 'n' = 0, the display is cleared from the cursor position to the end. If 'n' = 1, the display is cleared from the beginning to the cursor position. If 'n' = 2 the entire display is cleared, and the cursor is moved to the upper left (0, 0).

Erase all or part of line (ESC [n K)

Values (ASCII 27, 91, 48-50, 75 decimal / 1B, 5B, 30-32, 4B hex) Receipt of this character sequence causes part or all of the line that the cursor is on to clear. If 'n' = 0, the line is cleared from the cursor position to the end of the line. If 'n' = 1, the line is cleared from the beginning to the cursor position. If 'n' = 2 the entire line is cleared. The position of the cursor is not affected by this command.

Save cursor position (ESC [n s)

Values (ASCII 27, 91, 114 decimal / 1B, 5B, 73 hex) Receipt of this character sequence causes the display to save the current cursor position.

Restore cursor position (ESC [n u)

Values (ASCII 27, 91, 116 decimal / 1B, 5B, 75 hex) Receipt of this character sequence causes the display to restore the previously saved cursor position.

Query Device Status (ESC [5 n)

Values (ASCII 27, 91, 53, 110 decimal / 1B, 5B, 35, 6E hex) Receipt of this character sequence causes the display to generate an <ESC> [0 n status message. The 'n' character is actually part of the command and is not replaced by a number. If the display was configured for Switches Polled = 1, then this status message will be followed by any queued keypad response messages.

Query (ESC [6 n)

Values (ASCII 27, 91, 54, 110 decimal / 1B, 5B, 36, 6E hex) Receipt of this character sequence causes the display to report the current cursor position as <ESC> [row ; column R. The 'n' character is actually part of the command and is not replaced by a number. The value for row is 0 – 7, the value for column is 0 – 20.

Keypad Close Response

If the User Configuration setting for the keypad is set to **Scan/Matrix**, then the keypad response is as follows:

<SOH>
"K"
{Two Digit ASCII Hex keycode}
<ETX>

SOH

Value (ASCII 1 decimal / 01 hex). This character is used to reset/start the command processing state machine. It must be at the beginning of every SOH/ETX protocol command sent to the display.

K

Value (ASCII 75 decimal / 4B hex). Indicates start of Keypad Close response.

Keycode

Scan/Matrix Range (23, 2A, 30 hex – 39 hex). This specifies which key was pressed on the keypad

ETX

Value (ASCII 3 decimal / 03 hex). This character is used to delimit the response received.

If the User configuration setting for the keypad is set to **Debounce**, then the keypad response is as follows:

Input #	ANSI	Sequence	Value(s)
1	F1	ESC [O P	1B 5B 4F 50 00 00 00
2	F2	ESC [O Q	1B 5B 4F 51 00 00 00
3	F3	ESC [O R	1B 5B 4F 52 00 00 00
4	F4	ESC [O S	1B 5B 4F 53 00 00 00
5	UP ARROW	ESC [B	1B 5B 42 00 00 00
6	DOWN ARROW	ESC [A	1B 5B 41 00 00 00
7	ENTER	CR	0D

Power Up / Reset Response

No power up / reset response is sent when the display is configured for ANSI protocol.

Firmware Revisions

Version	Date	Notes
3.0	9/23/04	First release for new z8 based display hardware.
3.1	10/11/04	Made Keypad port pins open drain so that they go to 5v.
3.2	2/11/05	Implemented FONT_FIXED and ANSI scrolling terminal mode. Added NV_AnsiLineWrap and NV_AnsiLfToCr config items. Modified LCD_DisplaySettings() to show protocol status.
3.3	4/21/05	Added DisplayUnPrint() command to support MCE driver.
3.4	10/26/05	Added hardware receive flow control via RS-232 DTR signal.
3.5	10/27/05	Added 'b' backlight on/off command.
3.6	11/01/05	Changed keypad test so that scan/matrix or debounce switch configuration can enter configuration mode.
3.7	11/16/05	Fixed 'b' backlight command so that backlight commanded on will stay on after keypresses.
3.8	12/08/05	Re-init keypad configuration after testing for CONFIG or TEST power-up keypresses to correct broken down-arrow key in debounce configuration.
3.9	1/30/06	Added FONT_LARGE which is a bit doubled version of FONT_MEDIUM.
4.0	3/17/06	Added Switches Polled configuration option. Corrected SOH/ETX Reset response message to include the display address if non-zero. Added SOH/ETX protocol Keyboard Status Poll command. Added ANSI protocol Query Device Status and Query Cursor Position commands.
4.1	10/16/06	Added RS-485 configuration option for Rev 7 boards.
4.2	5/09/07	Added Keybeep Enabled, Frequency and Duration configuration options.

Updating the LCD128x64 firmware

The following procedure has been tested on Windows 2000 and Windows XP. The use of a standard PC COM port is advised, problems with USB COM ports have been reported.

1. Extract the files from the downloaded firmware zip file somewhere on your hard drive. Open a command prompt window, and navigate to the folder where you extracted the files. In the following example, the folder path is: **D:\Data\z8\ACS\LCD\128x64**

2. Move the pair of Normal/DBG jumpers on the LCD128x64 to the DBG position.

3. Power the display, connected to your PC's COM port.

4. Type the following command (underlined text) in the command prompt window:

   D:\Data\z8\ACS\LCD\128x64> flashutil lcd128x64.hex

   The utility should examine the available comm ports, find the display, and flash the firmware showing its progress on the command window:

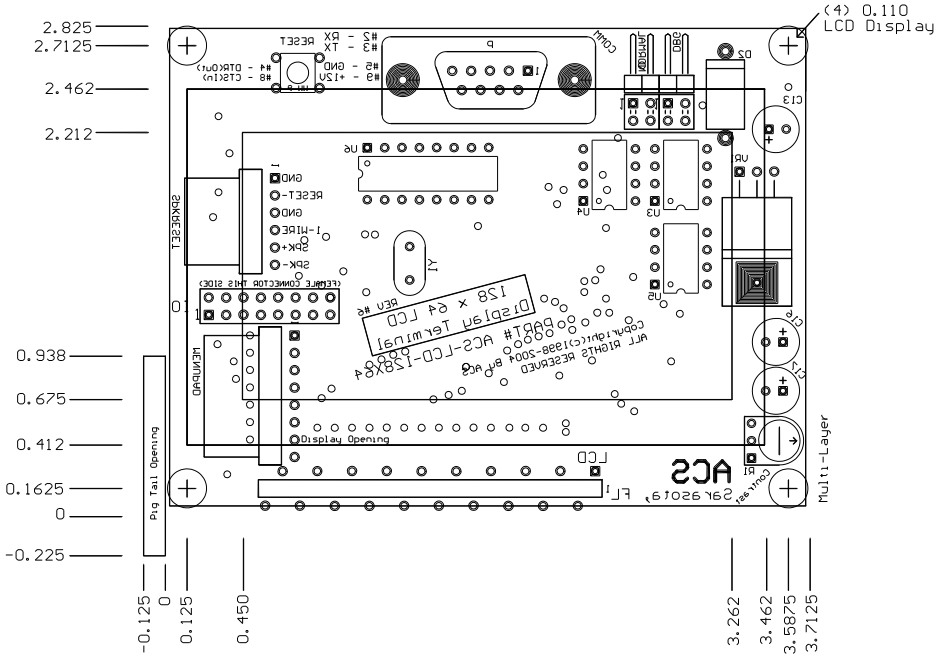
   ```
   ----
   D:\Data\z8\ACS\LCD\128x64> flashutil lcd128x64.hex
   Z8 Encore! Flash Utility - build Jan 23 2004 12:03:53
   Autoconnecting to device ... found on com1
   Memory size: 64k
   Reading file: lcd128x64.hex ... ok
   Erasing device ... ok
   Blank check ... ok, crc: ffff
   Programming device ... ok
   Verifying ... ok, crc: a4dd

   D:\Data\z8\ACS\LCD\128x64>
   ----
   ```

5. Restore the jumpers to the Normal position, and reset the display.

6. Because the firmware version was revised, the settings should default.

7. Verify the new firmware version # on the display.

Board Layout



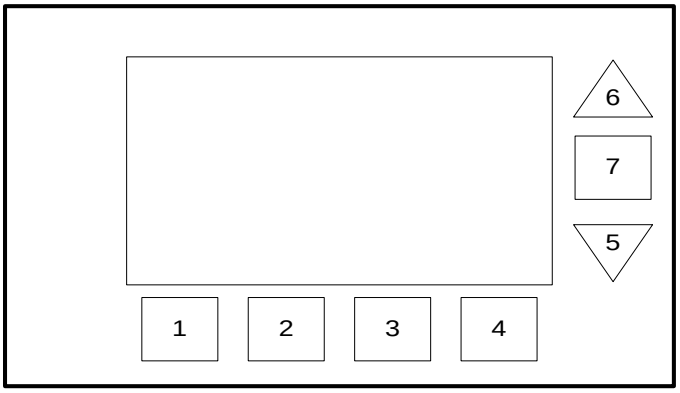
Keypad key code Layout

Debounce, SOH/ETX Protocol

1 (30 hex)	**2** (31 hex)	**3** (32 hex)	**4** (33 hex)	**5** (34 hex)	**6** (35 hex)	**7** (36 hex)

Debounce, ANSI Protocol

1 F1 (1B 5B 4F 50 00 00 00 hex)	**2 F2** (1B 5B 4F 51 00 00 00 hex)	**3 F3** (1B 5B 4F 52 00 00 00 hex)	**4 F4** (1B 5B 4F 53 00 00 00 hex)	**5 UP ARROW** (1B 5B 42 00 00 00 hex)	**6 DOWN ARROW** (1B 5B 41 00 00 00 hex)	**7 ENTER** (0D hex)



Membrane Switch Overlay

Scan/Matrix

3 Columns x 4 Rows

1 (31 hex)	**2** (32 hex)	**3** (33 hex)
4 (34 hex)	**5** (35 hex)	**6** (36 hex)
7 (37 hex)	**8** (38 hex)	**9** (39 hex)
***** (2A hex)	**0** (30 hex)	# (23 hex)

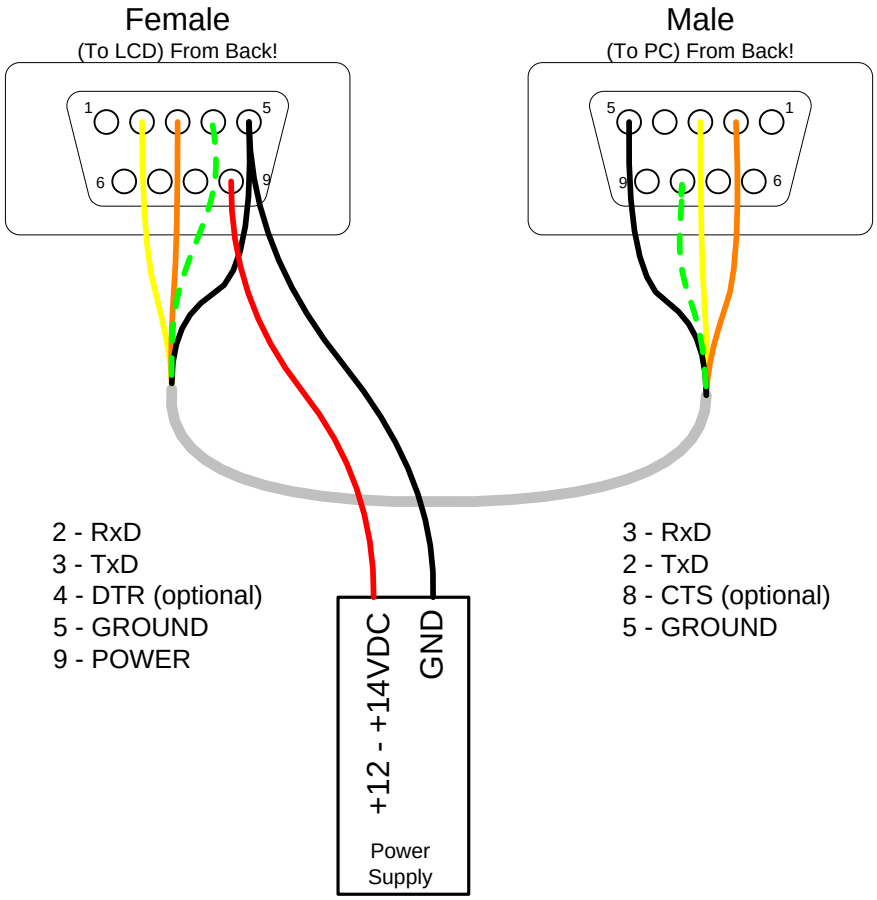
ASCII Table

Dec	Hex	Octal	Character
0	00	000	NUL (null)
1	01	001	SOH (start of heading)
2	02	002	STX (start of text)
3	03	003	ETX (end of text)
4	04	004	EOT (end of transmission)
5	05	005	ENQ (enquiry)
6	06	006	ACK (acknowledge)
7	07	007	BEL (bell)
8	08	010	BS (backspace)
9	09	011	TAB (horizontal tab)
10	0A	012	LF (line feed, new line)
11	0B	013	VT (vertical tab)
12	0C	014	FF (form feed, new page)
13	0D	015	CR (carriage return)
14	0E	016	SO (shift out)
15	0F	017	SI (shift in)
16	10	020	DLE (data link escape)
17	11	021	DC1 (device control 1)
18	12	022	DC2 (device control 2)
19	13	023	DC3 (device control 3)
20	14	024	DC4 (device control 4)
21	15	025	NAK (negative acknowledge)
22	16	026	SYN (synchronous idle)
23	17	027	ETB (end trans. block)
24	18	030	CAN (cancel)
25	19	031	EM (end of medium)
26	1A	032	SUB (substitute)
27	1B	033	ESC (escape)
28	1C	034	FS (file separator)
29	1D	035	GS (group separator)
30	1E	036	RS (record separator)
31	1F	037	US (unit separator)
32	20	040	Space
33	21	041	!
34	22	042	"
35	23	043	#
36	24	044	$
37	25	045	%
38	26	046	&
39	27	047	'
40	28	050	(
41	29	051	)
42	2A	052	*
43	2B	053	+
44	2C	054	,
45	2D	055	-
46	2E	056	.
47	2F	057	/
48	30	060	0
49	31	061	1
50	32	062	2
51	33	063	3
52	34	064	4
53	35	065	5
54	36	066	6
55	37	067	7

56	38	070	8
57	39	071	9
58	3A	072	:
59	3B	073	;
60	3C	074	<
61	3D	075	=
62	3E	076	>
63	3F	077	?
64	40	100	@
65	41	101	A
66	42	102	B
67	43	103	C
68	44	104	D
69	45	105	E
70	46	106	F
71	47	107	G
72	48	110	H
73	49	111	I
74	4A	112	J
75	4B	113	K
76	4C	114	L
77	4D	115	M
78	4E	116	N
79	4F	117	O
80	50	120	P
81	51	121	Q
82	52	122	R
83	53	123	S
84	54	124	T
85	55	125	U
86	56	126	V
87	57	127	W
88	58	130	X
89	59	131	Y
90	5A	132	Z
91	5B	133	[
92	5C	134	\
93	5D	135	]
94	5E	136	^
95	5F	137	_
96	60	140	`
97	61	141	a
98	62	142	b
99	63	143	c
100	64	144	d
101	65	145	e
102	66	146	f
103	67	147	g
104	68	150	h
105	69	151	i
106	6A	152	j
107	6B	153	k
108	6C	154	l
109	6D	155	m
110	6E	156	n
111	6F	157	o
112	70	160	p
113	71	161	q
114	72	162	r
115	73	163	s
116	74	164	t

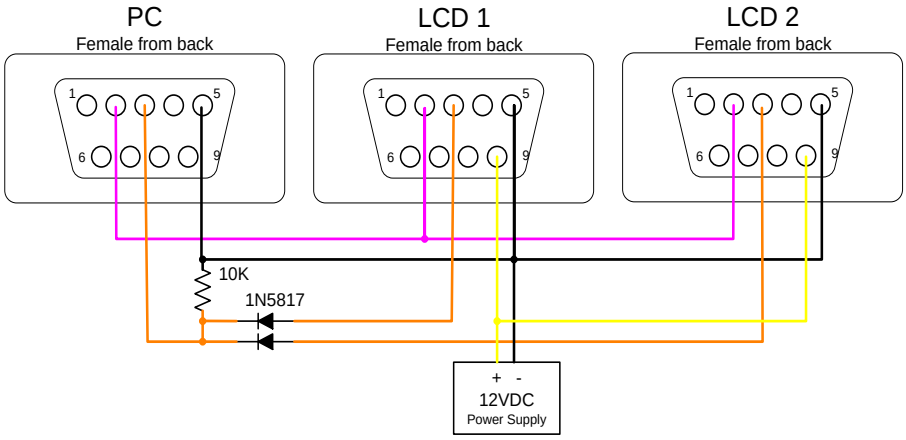
117	75	165	u
118	76	166	v
119	77	167	w
120	78	170	x
121	79	171	y
122	7A	172	z
123	7B	173	{
124	7C	174	|
125	7D	175	}
126	7E	176	→
127	7F	177	←

Wiring Harness Diagram

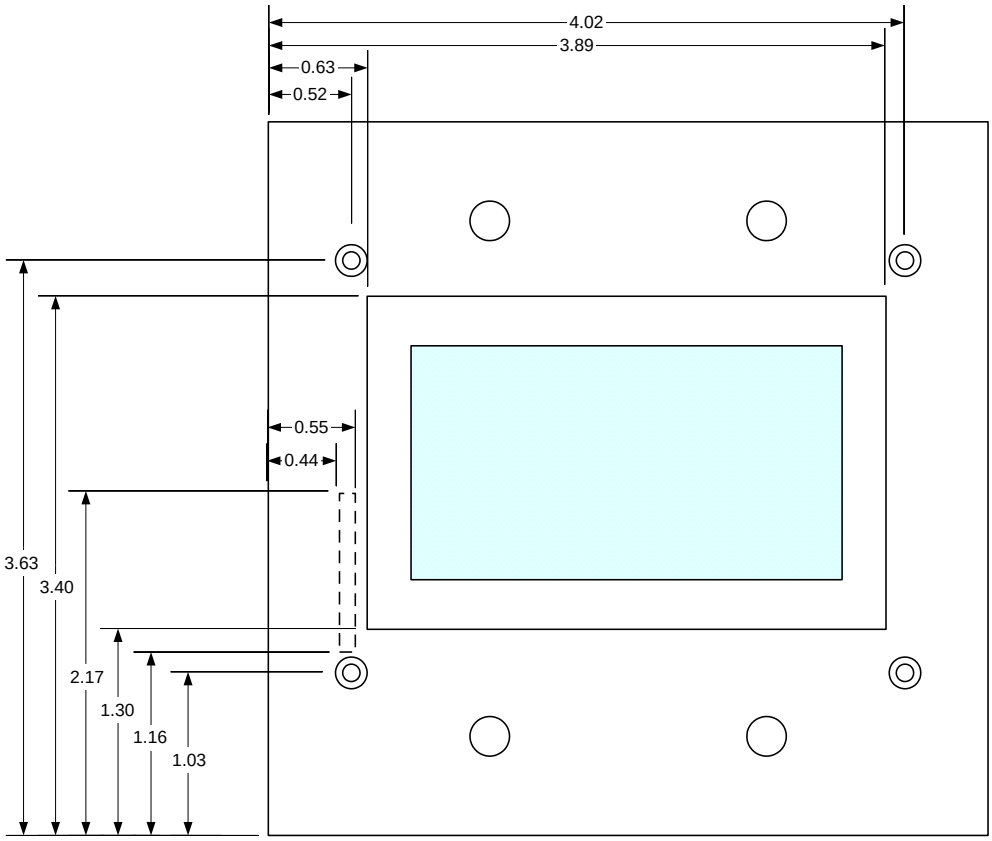


Multiple Display Wiring

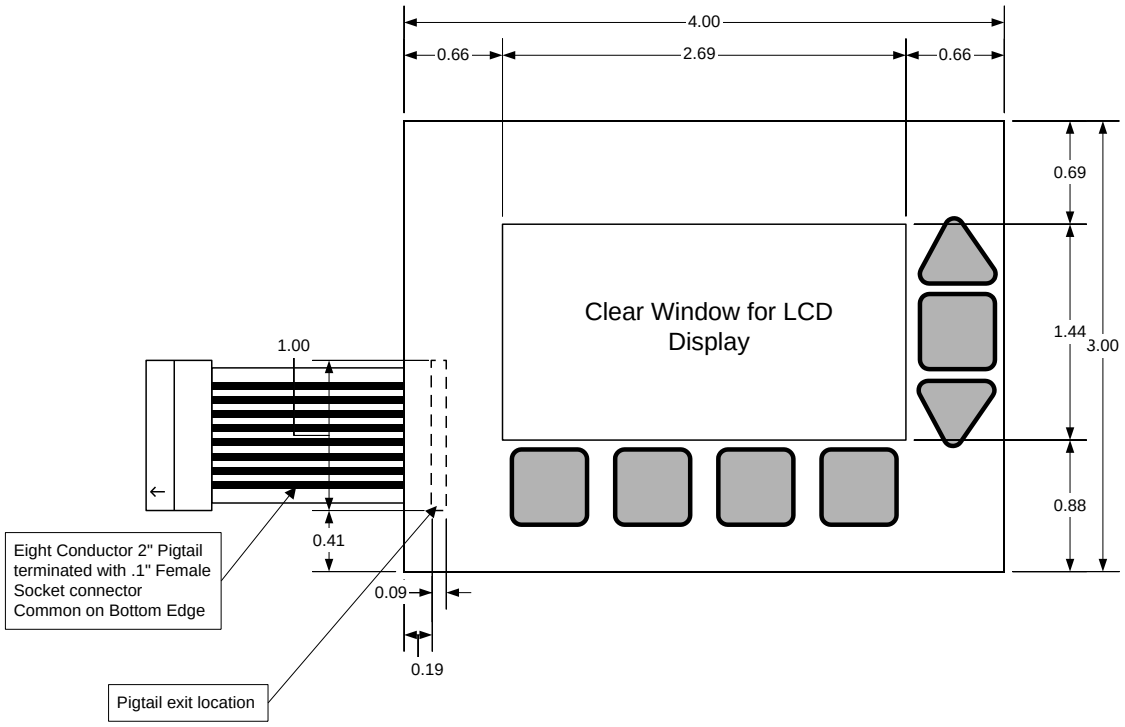
Multiple displays can be connected by wiring the transmit data lines to the LCDs together, and 'OR'ing the receive data lines from the LCDs using low voltage drop Schottky diodes and a resistor to ground. Data to be displayed may be directed to the required display by configuring the display's **'Display Comm Addr'** and using the addressed communications outlined in the **Display Addressing** section above.



Mechanical Mounting Diagram



Membrane Switch Overlay



NOTICE:

This Information or any portion thereof remains the property of ACS. The Information contained herein is believed to be accurate and ACS assumes no responsibility or liability for its use in any way and conveys no license or title under any patent or copyright and makes no representation or warranty that this Information is free from patent or copyright infringement.

ACS warrants that the specified product shall function in accordance with the features of the design for a period of one (1) year from the date of purchase. This warranty does not cover any ACS product which has been subjected to any abuse, misuse, accident, act of God, alteration or modification not authorized by ACS in writing. ACS offers no other warranty, either expressed or implied and specifically denies all other warranties, including any warranty for merchantability or fitness. ACS's sole obligation upon the discovery of any error in the specified product or breach of the warranty in this paragraph shall be to replace or repair the specified product or to correct the design of the specified product. Under no circumstances shall ACS, its owners, officers, employees or agents be held liable for any special, incidental, indirect, consequential or other damages (including lost profits, fees or revenues). Any purchase of our products or use of our services constitutes your complete agreement and binds you and your company to all the terms, policies, conditions and prices as is herein described.

ACS PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF ACS.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.